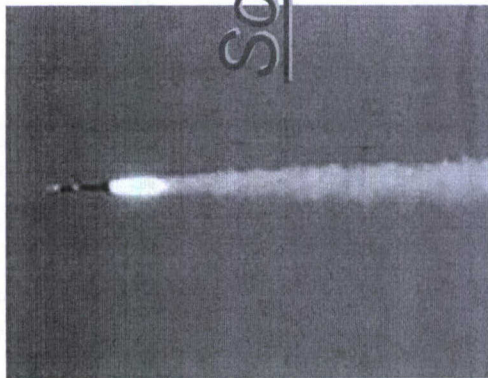
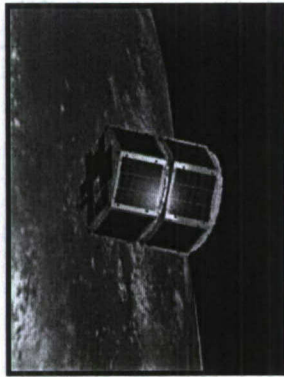


REPORT DOCUMENTATION PAGE				Form Approved OMB No. 0704-0188	
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1. REPORT DATE (DD-MM-YYYY)		2. REPORT TYPE FINAL REPORT		3. DATES COVERED (From - To) 01 APR 2003 - 31 MAR 2007	
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				5b. GRANT NUMBER FA9550-03-1-0210 F45620-	
				5c. PROGRAM ELEMENT NUMBER 61102F	
				5d. PROJECT NUMBER 2305/IX	
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12. DISTRIBUTION/AVAILABILITY STATEMENT DISTRIBUTION STATEMENT A: UNLIMITED				AFRL-SR-AR-TR-08-0136	
13. SUPPLEMENTARY NOTES					
14. ABSTRACT - Detailed subsystem designs have been completed including communications, power, GPS, thruster, structure, and separation system - Most of these subsystems have had working engineering models fabricated and tested - A detailed project document tree has been created and populated with requirements, subsystem designs, operational modes, and system test procedures - A KC- 135 weightless experiment was conducted by students to demonstrate and measure the tip off properties of the Lightband separation system for dynamics analysis					
<div style="font-size: 2em; font-weight: bold; margin: 0;">20080331069</div>					
15. SUBJECT TERMS					
16. SECURITY CLASSIFICATION OF:			17. LIMITATION OF ABSTRACT		18. NUMBER OF PAGES
a. REPORT	b. ABSTRACT	c. THIS PAGE			19a. NAME OF RESPONSIBLE PERSON
					19b. TELEPHONE NUMBER (Include area code)

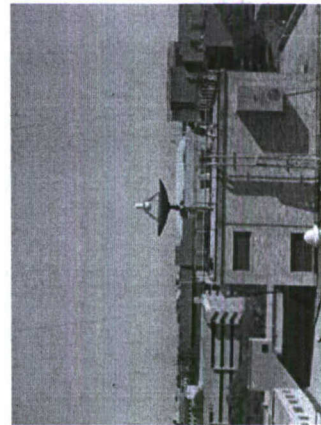


So, You Want To Build A Satellite?

**E. Glenn Lightsey,
Associate Professor
Dept. of Aerospace Engineering**



January 17, 2007



<http://fastrac.ae.utexas.edu>



Satellite Design Lab Students: A Partial List!



“Scientists discover the world that exists;

Engineers create the world that never was.”

**-Theodore von Karman,
*Aerospace Engineer***

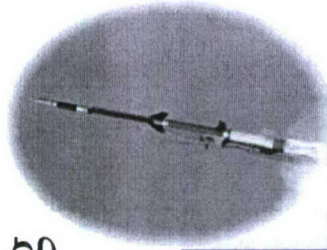
....And Many More!! (more than 100 students)



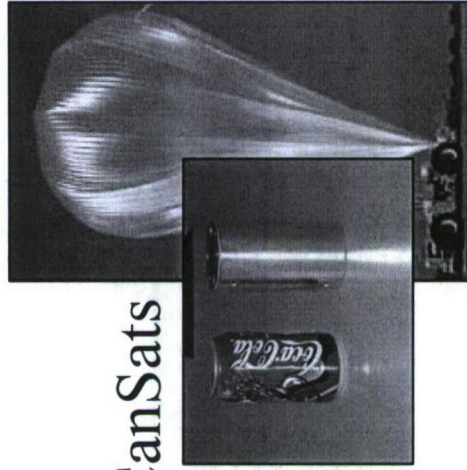
UT Austin Satellite Design Laboratory (SDL)

Mission Progression

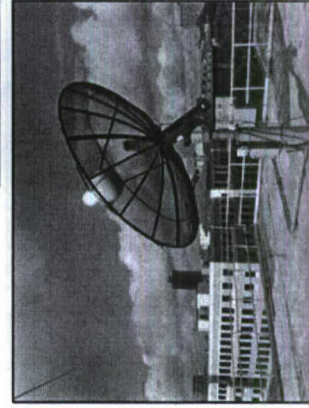
Sounding
Rockets



CanSats

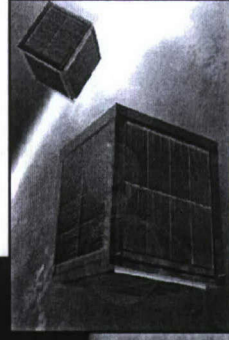
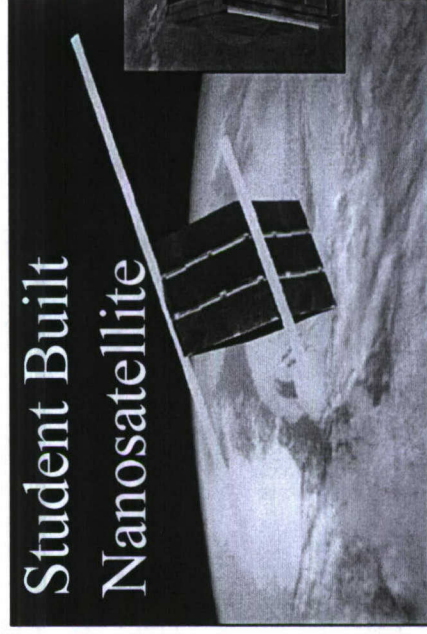


High Altitude
Balloons



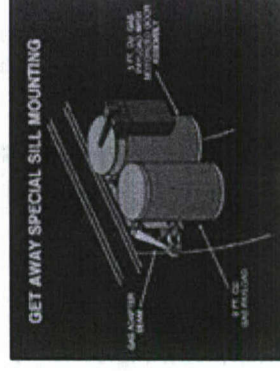
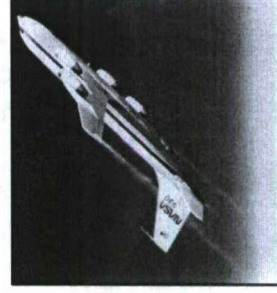
Satellite Ground Station

Student Built
Nanosatellite



Nanosat
Groups

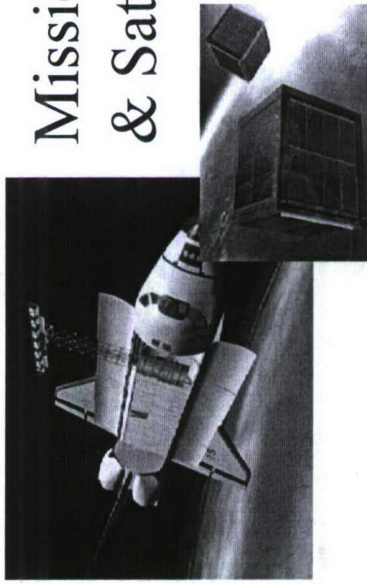
KC-135/C-9



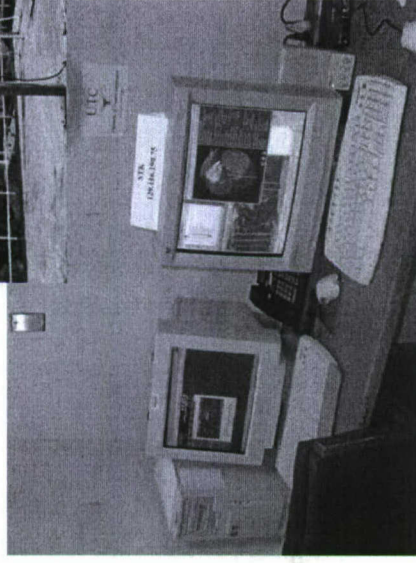
Get Away Special



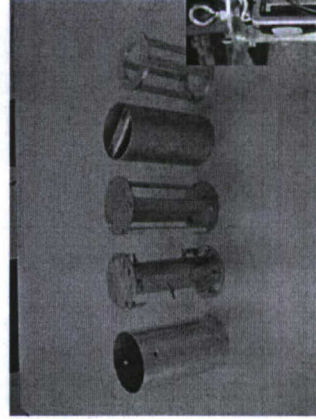
Product Life Cycle Engineering



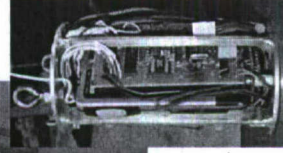
Mission Planning
& Satellite Design



Flight Support
& Tracking



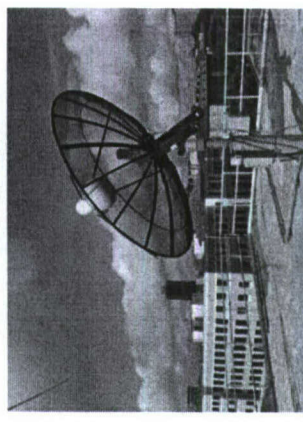
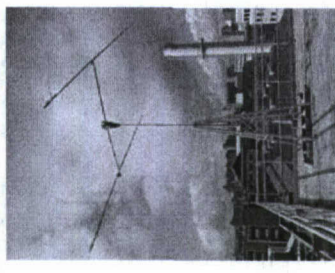
Vehicle
Integration
& Testing





Satellite Ground Station

- Antenna Motion Control
 - APRS Based Tracking
 - Signal Strength Based Tracking
 - RF Environment Mapping
- Transceiver Control
 - Doppler Correction
 - Scanning Algorithms
- TNC Control
 - Multi Mode Decoding APRS, AMTOR, RTTY, AX.25 Morse, etc.
 - Graphical User Interface
- RACE Network
 - Scheduling and Remote Control

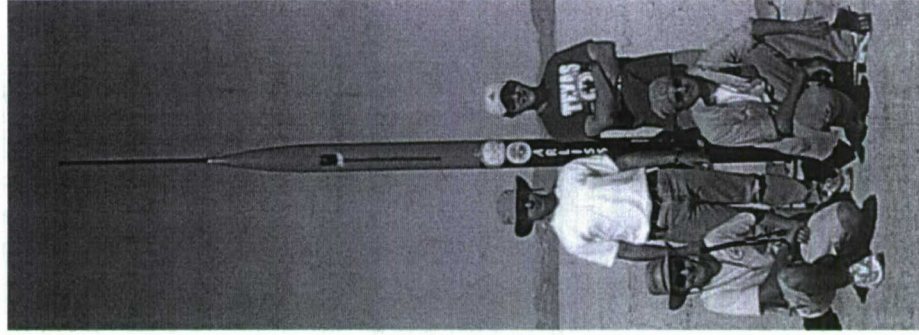




We Started Small: CanSat....

Mission Profile

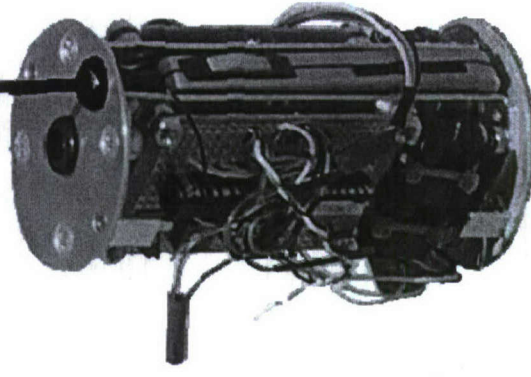
- "Starter Project" : 6 students, 6 months, \$2,000
- Sounding Rocket Launch to 12,000 ft. AGL
- 35-g Launch Load Typical
- Parachute Descent Emulates Satellite Pass
- First UT Launch: Summer 2002 Black Rock Desert



2003 Launch Team

• CanSat 2002:

- Coke Can Sized
- Weight: 166 gm.
- Two-way Telemetry 9600 bps.
- Pressure and Temperature sensors
- Recorded Accelerometer Data
- Uplink Commands



UT CanSat May 2002

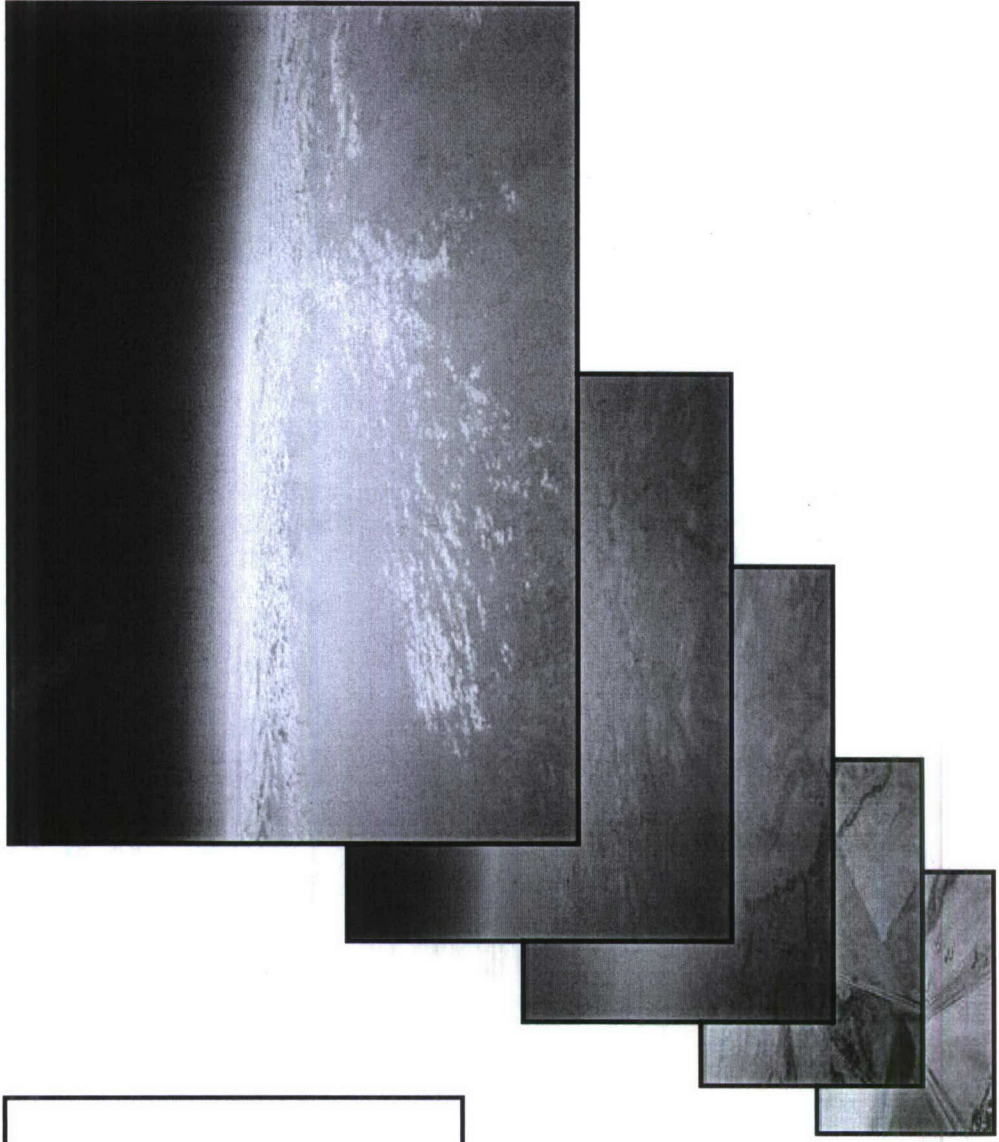


High Altitude Balloon Workshop

July 2003

Successful Outcome

- Solid Core Team
- Increased Confidence
- Experience Gained
- Pretty Pictures
- SDL Altitude Record (100,000 ft)





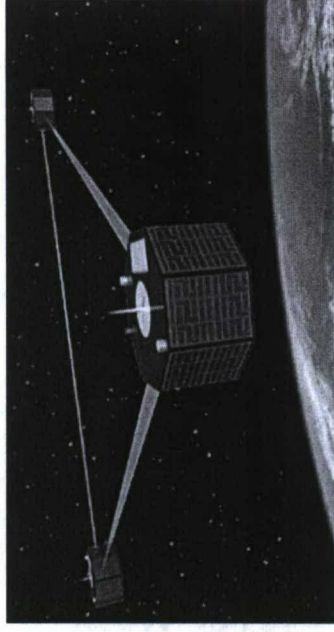
...And Grew to Space Missions: FASTRAC

2003 - 2007

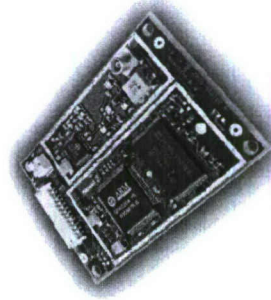
FASTRAC demonstrates many critical unflown technologies for future space applications in one low-cost mission.



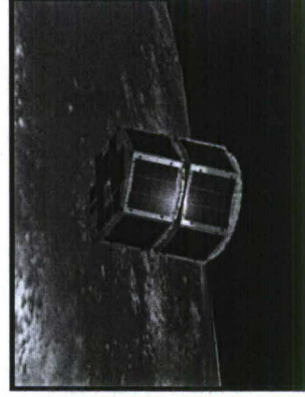
Standalone Relative Navigation



Distributed Formations



Advanced GPS Receiver
(Patented – seeking commercialization)

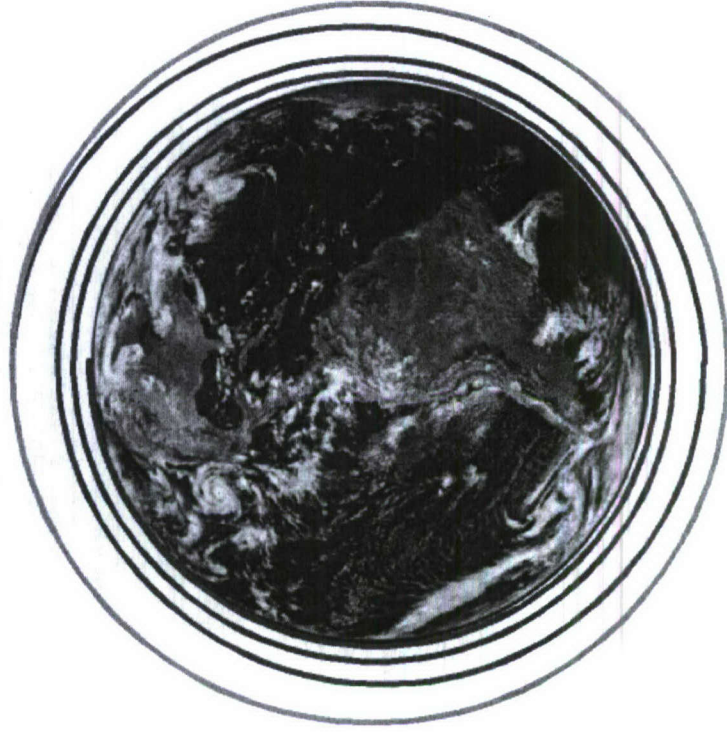
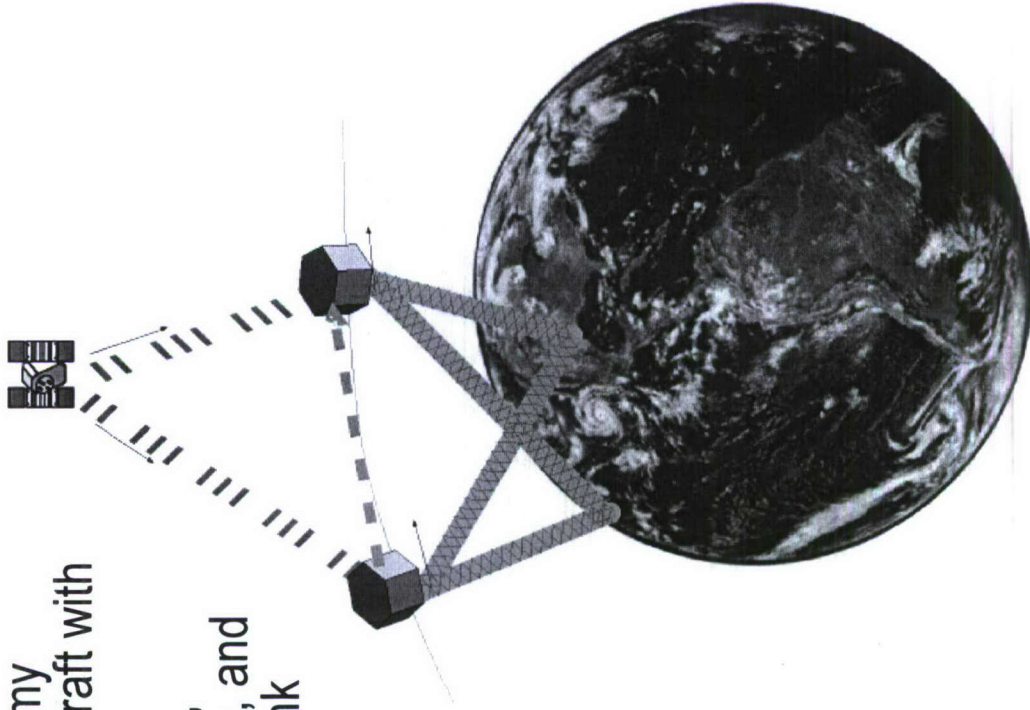


Microthruster Propulsion



FASTRAC Mission Overview

Formation
Autonomy
Spacecraft with
Thrust,
RelNav,
Attitude, and
Crosslink





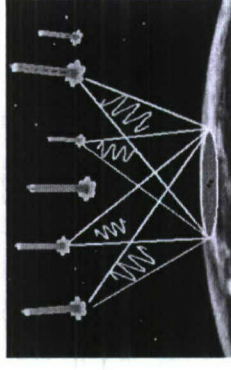
Satellite Formations Enable New Mission Types and Space Capabilities

Real-time Reconnaissance and Remote Sensing

- Surface observation (before/after)
 - Global sea height & surface wind measurements
 - Three Dimensional Hyperspectral Imaging
- *Formations allow real-time observation of large areas with greater accuracy than single satellites.*



TechSat 21 Cluster

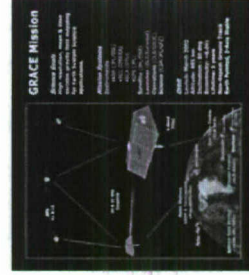
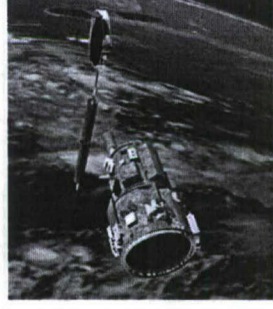


Rapidly Deployable Communications Arrays

- Over the horizon & Store-and-Forward Comms.
 - Secure & Jam-resistant Comms.
- *Formations provide undeniable communications systems in conflicted air space.*

Multi-vehicle Proximity Missions

- Inspection and Rendezvous
 - Autonomous Servicing, Repair, Upgrade
- *Formations enable satellites to work together autonomously.*



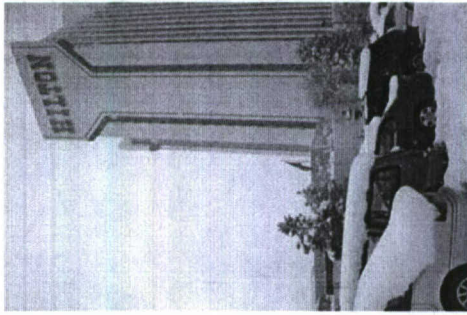
Science Arrays and Virtual Instruments

- Interferometry, Field Measurements
 - Geophysical and Atmospheric Science
- *Formations allow multiple observation locations to be employed simultaneously.*

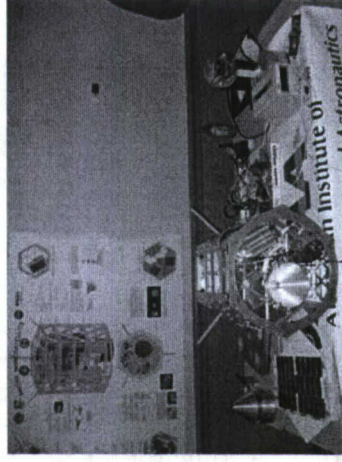


UN-3 Competition Day January 9, 2005

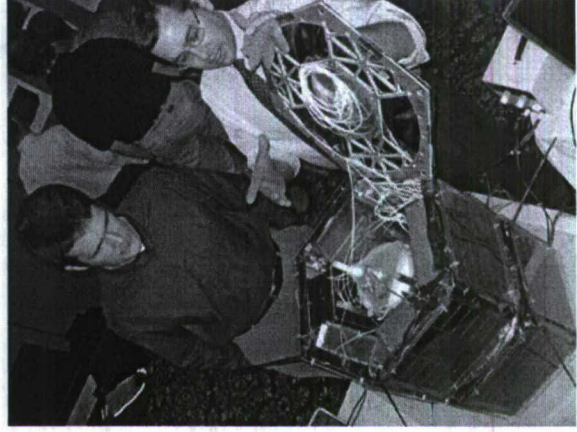
Getting There



The Competition: 12 other Universities



Presentation, Q&A





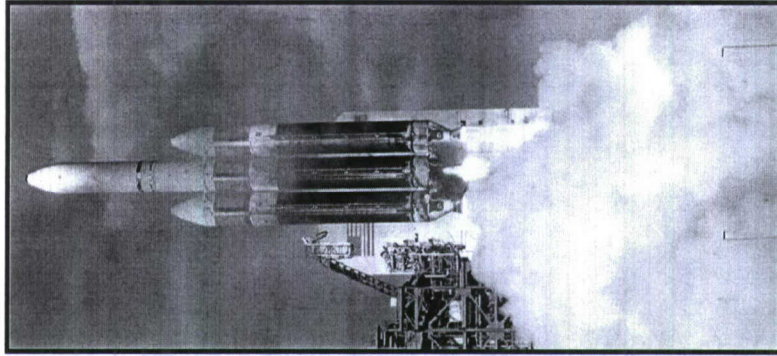
The Result

FASTRAC Wins!

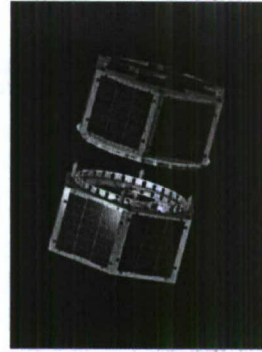




FASTRAC: What's Ahead



Example Launch Opportunity



FASTRAC On-Orbit Separation

Flight Build / Pre-Launch

- **Fall 2005:** Briefed and ranked by the DOD SERB
- **Spring 2006 :** Complete Flight Build in Austin
- **June 2006 :** Deliver Flight Unit to AFRL AEF
- **Summer/Fall 2006 :** Environmental Testing at AFRL
- **Early-Mid 2007:** Manifest to launch vehicle
- **Late 2007-08:** Launch and Mission Operations

Press Opportunities

Mission Operations

- **First 2-weeks:** Stack check-out period
- **2-months:** Primary mission operations
- **4-months:** Amateur Radio Community Outreach and Secondary Mission Operations (extended)

End-of-Mission and Post-Flight

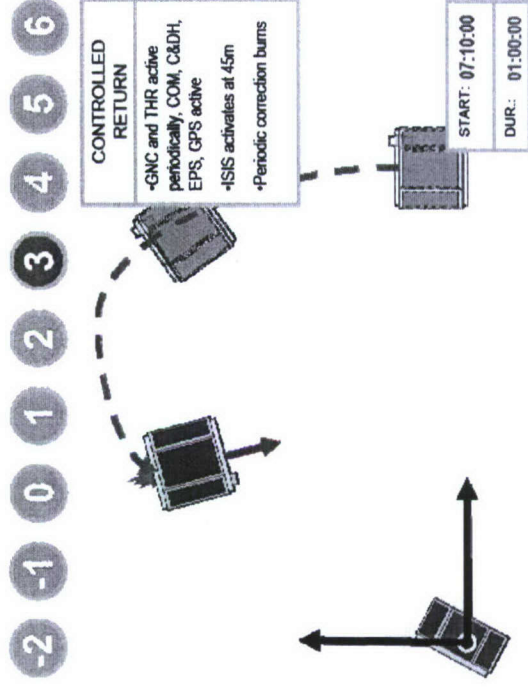
- **Post Flight Analysis** and Publication of Results (**2007-08**)



Future Satellite Missions

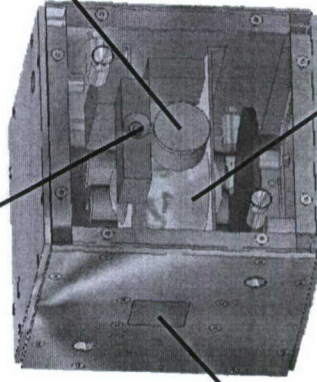
ARTEMIS: 2005-2010

Autonomous Rendezvous Mission
Selected as Nanosatellite Finalist
Funded \$500K in 2006-07 by DOD
Technology Spinoffs



Laser Rangefinder

Electromagnet



Antenna

Propellant Tank

PARADIGM: 2006-2014

10 cm cube satellite

Joint Venture with UT-Austin, Texas A&M, NASA
4 Launch Opportunities over 8 year period
Numerous New Technologies

The Future: A major NASA/DOD mission built by The University of Texas